Test Management for Avionic Systems using Quality Center Technische Universität Dresden - Informatik

DEFENCE AND SPACE

Frank Westerbuhr, Expert System Test and Test Tools 27th of January 2020



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AIRBUS

Introduction

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Strong, innovative and customer focused – Our portfolio.

Military Aircraft



- A400M
- A330 Multi-Role Tanker Transport
- Special Mission Aircraft
- Combat Aircraft
- Full In-Service Support

Space Systems



- Telecommunication Satellites
- Earth Observation Satellites
- Navigation Satellites
- Orbital and Space Exploration
 Infrastructure
- Science Missions
- Launchers (ArianeGroup)

Communications,

Intelligence and Security



- Intelligence
- CyberSecurity
- Security Solutions
- Secure Communications
- Secure Land Communications
- Future Applications

Unmanned Aerial Systems



 UAS and UAV solutions for airborne intelligence, surveillance and reconnaissance, and combat missions

Military Aircraft Centre Manching





Military Aircraft System Test – Overall Process



unclassified

Military Aircraft System Test – Laboratory Test Environment



Avionic System Test using Quality Center



Usage of Quality Center at UAV Technology Projects

UAV Sagitta, MTOW 150kg

- Overall System-, System-, Equipment SW Test
- Laboratory Test, On Aircraft Ground Test
- About 20 User (System-, SW-, Test Engineers)
- First-flight without any problems

FCAS Manned-unmanned Teaming

- Overall System-, System-, Equipment SW Test
- Laboratory Test
- About 35 User (System-, SW-, Test Engineers)
- First-flight without any problems

UAV: Unmannded Aerial Vehicle FCAS: Future Combat Air System MTOW: Max. Take-off Weight



Open Innovation Project Sagitta – Partner Contributions



Test Management for Avionic Systems using Quality Center, Frank Westerbuhr

Open Innovation Project Sagitta – Complex System Architecture

- 70 Avionic Computer
- 25 Processors
- 4 CAN Busses
- 10 RS422
- 9 RS232
- 1 GBit Ethernet



Open Innovation Project Sagitta – From Manufacturing to First Flight

Test Management using Quality Center

3 - On A/C Ground Test



4 - Flight Test



1 - Manufacturing



2 - System Integration and Laboratory Test

Test Management for Avionic Systems using Quality Center, Frank Westerbuhr

System Test Process – Application of IEEE 829 and ISTQB



System Test Process – Document Generation using Quality Center Modules



Releases	X							
Libraries	X							
Test Plan	X	X	X	X				
Test Lab							X	
Test Runs					X		X	
Defects						X		X
Requirement								X

System Test Process – Requirements in QC

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86	No Filter Defined	Details Rich Text	Attachments Linked Defects Re	equirement Traceability	Test Coverage Busines	ss Models Lir 🤇 🕽
Q K	Name ^	•Name:	CA-SG-270-RQ-0012-404	 Requirement Type: 	🛴 Req	~
	▶ E L0_L1_System_Sagitta ↓ E L2_System_FMS	Allocation:	FCS	Author:		~
	- E SRD	Compliance Status:	Fully Compliant 🗸	Coverage Accepted:	True	~
II ا	Certification Requirements	Coverage Analysis Re	Fully Covered 🗸	Creation Date:	04.02.2015	~
_	- Functional Requirements	Creation Time:	10:19:15	Direct Cover Status:	Not Completed	~
8	→ Support System Maintenance (SAG)	DOORS_ID:	CA-SG-270-RQ-0012-404	Implemented:		~
	 Load Software and Databases (SAG) Support System (XBIT-)Testing and Ca 	MoC Verification:	MoC 5 - Ground Tests on A/C	Modified:	27.03.2017 16:45:24	
1	✓ Perform (XBIT-)Testing of the Gree	Phase:	Phase 1	Priority:		~
-		Req ID:	89	Reviewed:	Not Reviewed	~
	L CA-SG-270-RQ-0012-402	SRD Ln-1:		Target Cycle:	L0/L1 Formal Overall S	Syste 🔜 🗸
	CA-SG-270-RQ-0012-673 Find Perform Equipment Calibration of the	Target Release:	Full Functional A/C;Full Fu			
	General Functions (SAG)	Description Comment	s Additional Info Assumption	Comments to Coverage	Deviation Limitation	Reference
	Perform Test (SAG)					
	System Behaviour	The FMS shall initiate XBIT	as defined in the FMS enhanced Failu	Intel ist ref CA_SG_000_P_0022	A) upon command from the	actor GC and
	Performance Requirements Operational Requirements	provide the results to the a	ctor GC.	10 List 161, CA-3G-000-R-0022-		actor Ge and
	Safety Requirements					

System Test Process – Test Cases in QC

₩ ₩	Image: Second secon	Details Design Ste	os Parameters Test C	onfigurations	Attachments	 Req Coverage 	Linked Defects	Dej < >
	V V V Name	Test Name:	Air Segment Personal Safe	ty	•Type:	🖹 MANU	JAL	
N.	▶ J Unattached		10.00.2015					
	to be deleted	Creation Date:	10.08.2015	~	Designer:			v
	Common Test Cases	Status:	Ready	~	Test ID:	505		
1	Flight Test							
A	↓ L0_L1 Sagitta							
	▶ 🔚 Blue System							
	▶ 🚞 Flight Managment System							
	Flight Test Equipment							
65	General Systems							
	Ground Segment & Comms System							
1	Overall Aircraft							
	🗸 🥁 Personnel Safety Green System							
	🕞 Air Segment Personal Safety							
	Propulsion System							
	Termination System	Description Comment	5					
	L2 EPGS	The Tart of the	<u> </u>					
	E L2 FMS			")(" ⊞		≪ ⊠		
	► C PRP	Objective:						^
	E L3 FMCS This test case verifies the implemented Personnel Safety functions of the Air Segment. In particular the operation and status of the Safety Interlocks for protecting the personnel from hazards originating from the Green System are checked.				t -			
		E Inputs:						
		 Power up the Gro Ensure that the satisfies 	und Station fety pin connector on the sta	rtup panel is j	plugged in (i.e safe	e position / critica	I functions disable	ed)

System Test Process – Test Sets in QC



r mor bronnes						
8 🐥 🏲 🕇	st	Name	Status	Exec Date	Tim	
107	4 [1]Air Segmer	nt Personal Safety	Passed	28.02.2017	16:27:09	
at Due Depart						
ast Kun Keport						
Step Name	Status	Exec Date	Steps Details			
Step 1	Passed	28.02.2017	Description: Remove Safety Pin or set Safety switches to "UNSAI position			
Step 2	Passed	28.02.2017				
Step 3	Passed	28.02.2017	- position.			
Step 4	Passed	28.02.2017	On the Startup Laptop	Command GCEs and	ACEs from ST	
Step 5	V Passed	28.02.2017	OP Mode according to Monitor Mo	general power-up pro de indications on FMC	ocedure	
Step 6	V Passed	28.02.2017	Expected: GCEs and ACEs are in "OP" Mode			
Step 7	V Passed	28.02.2017				
Step 8	V Passed	28.02.2017				
Step 9	V Passed	28.02.2017				
Step 10	V Passed	28.02.2017				
Step 11	Passed with De	viatio28.02.2017				
Step 12	V Passed	28.02.2017	Actual:			
01- F	Danaed	28.02.2017				

17 27th of January 2020

Project Specific Customization of QC Requirement Attributes

Allocation of Function Allocation of System e.g. Manage System, Manage Health, Display Situation e.g. Propulsion System, Navigation System, Mission Computer

Means of Compliance

e.g. Analysis, Lab Test, Ground Test, Flight Test, Simulation

Coverage Analysis Result Coverage Accepted Not Analysed, Not Covered, Partially Covered, Fully Covered True, False

Compliance Status

Not Analysed, Not Compliant, Partially Compliant, Fully Compliant

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Project Specific Customization of QC Requirement Attributes (Memos)

Assumption

Description of Assumptions

Rational for Coverage Result

Comments to Coverage

Deviation

Limitation

Rationale

Reference

Deviations of System against Requirement

Limitation of System

Additional information about Requirement

List of referenced Documents



Definition of Requirement Contents

Imported from DOORS:

Name	Responsible
Requirement Name	System Engineer
Requirement Type	System Engineer
Allocation to Function	System Engineer
Allocation to System	System Engineer
Means of Compliance	System Engineer
Description	System Engineer
Assumptions	System Engineer
Rationale	System Engineer

Defined in QC:

Name	Responsible
Compliance Status	System Engineer
Coverage Analysis Result	System Engineer
Coverage Accepted	System Engineer
Priority	System Engineer
Comments to Coverage	System Engineer
Deviation	System Engineer
Limitation	System Engineer
Direct Cover Status	Test Engineer
Target Release, Cycle	Test Manager



Definition of Test Case Contents

Defined in QC:

Name	Responsible
Test Name	System Engineer
Test Description	System Engineer
Reqirements Coverage	System Engineer
Design Steps	Test Engineer
Test Script (outside QC)	Test Engineer

Note: One person can have several roles – System as also Test Engineer

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System Test Automation

- Test Script control from QC VAPI XP
 Tests using XML Remote Procedure Calls
- Automated transfer of test execution data to QC
 - Test Step Name, Expected, Actual
 Test Analysis data
 - System-/Software Configuration data
 Test Environment Configuration data
- Test Execution feedback available in QC immediately after execution



Outlook

- Migration of System- and Equipment Tests to QC at a TORNADO Mission System
- Preparation of HW/SW Integration Tests migration to Octane at an Eurofighter Mission System
- Introduction of ALM at one new major Unmanned Aerial Vehicle project

o Multi-company, -site, -country setup

o Introduction of Value Stream Management

o Agile SW development / waterfall System Test, triggered by sprints of SW development

o Automated Testing on SW-in-the-loop and HW-in-the-loop environments





Thank you

